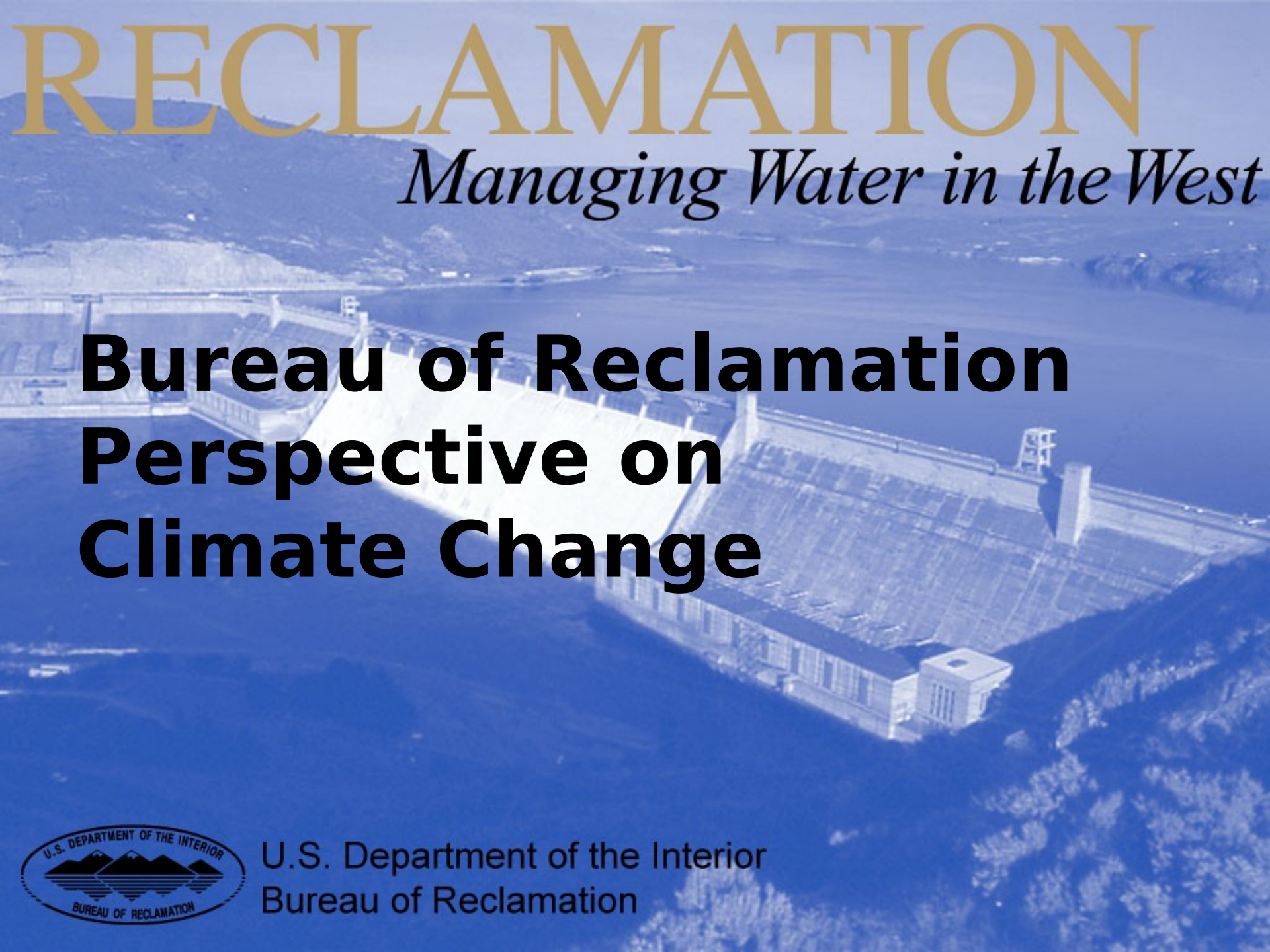

Bureau of Reclamation Perspective on Climate Change

U.S. Department of the Interior
Bureau of Reclamation

Climate Change Questions

- How might Climate Change affect Reclamation's operations?
- What is Reclamation doing?

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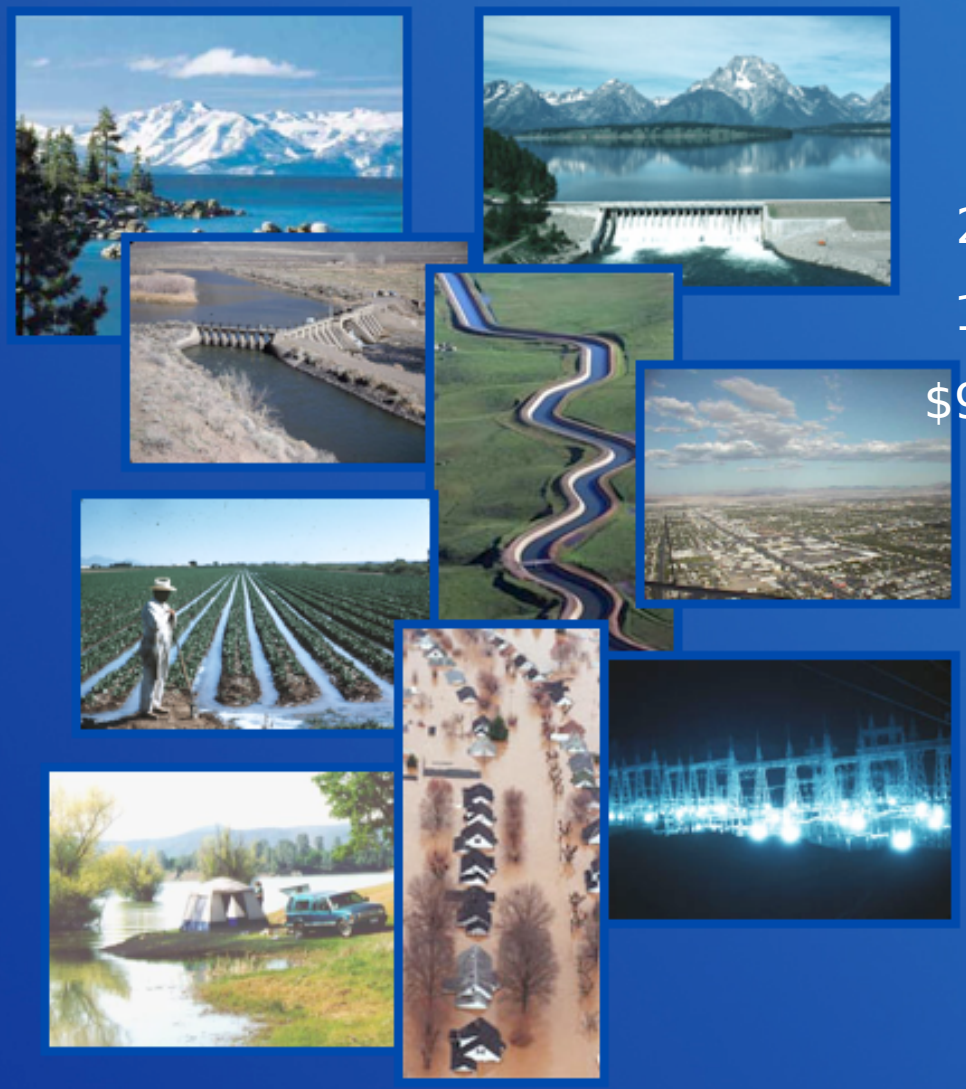

348 Reservoirs

245 Million acre-feet of water storage

254 Diversion dams

16,000 Miles of canals

$9 Billion annual agricultural benefits

M&I benefits to more than 31 million people

58 Hydropower facilities powering over 6 million homes

308 public recreation areas visited by more than 90 million people each year

More than $12 billion avoided flood damages since 1959

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Bureau Regions and Facilities

- Bureau Regions
- Regional Offices
- Power Plants
- Dams

RECLAMATION

Why Is Reclamation Concerned about Climate Change?

- **The warming that we are experiencing affects runoff and water demand patterns in our river basins.**
- **All projections are showing that it will be warmer in the west in the future.**
- **Reclamation is working to understand the science and how to incorporate this into our operations and project planning.**

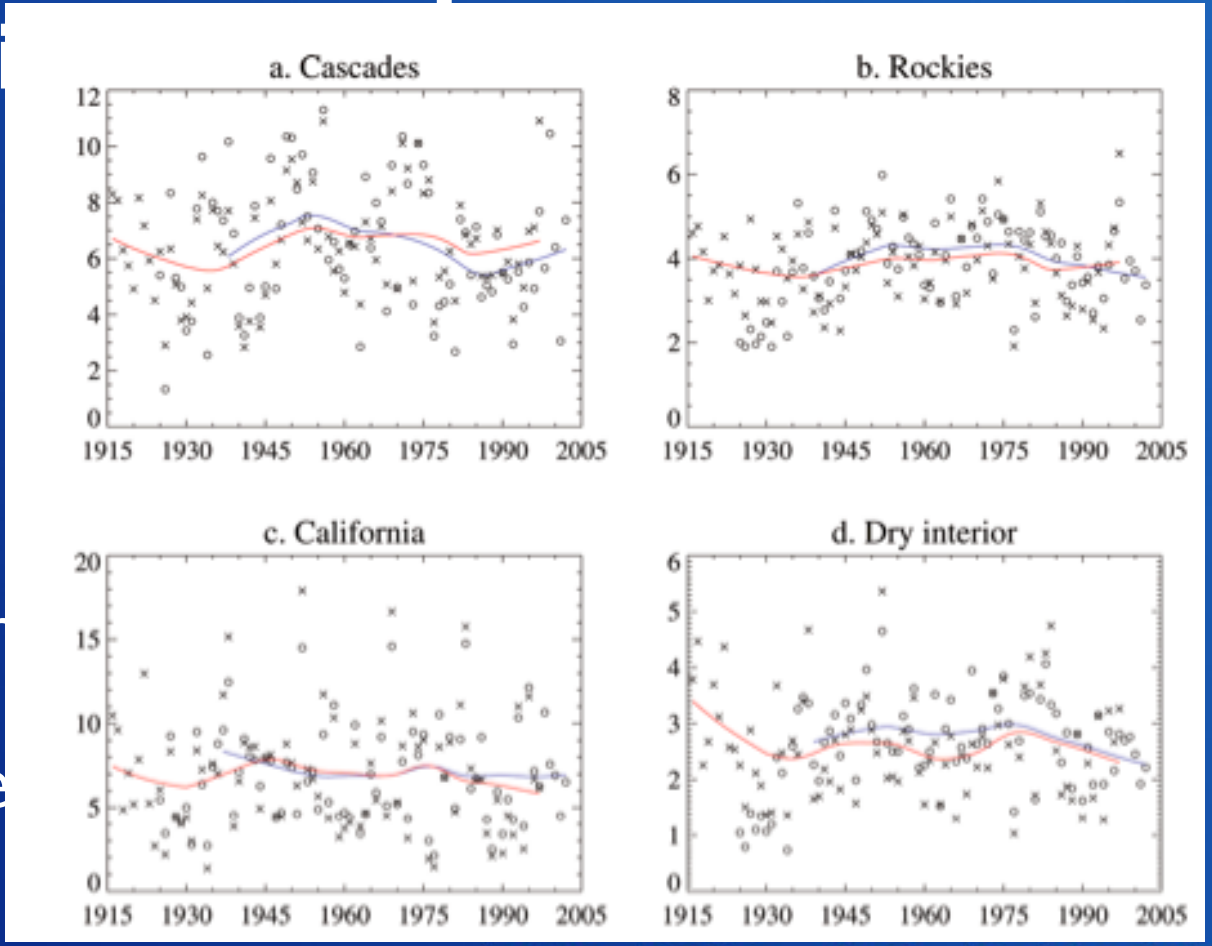
Dealing With Uncertainty: The Colorado River

- **Projected reductions in natural flows by the mid- 21st century**
  - **~45% Hoerling and Eischeid (2007)**
  - **20 - 30% Milly (2005)**
  - **~18% Christensen et al. (2004)**
  - **Seager et al. (2007) "imminent transition to a more arid climate in southwestern North America"**

Photo by D. Larry Anderson

RECLAMATION

Historically, Reclamation has managed its projects in the West within an envelope of climate variabili



Snow Water Equivalent from Mote et al. 2005

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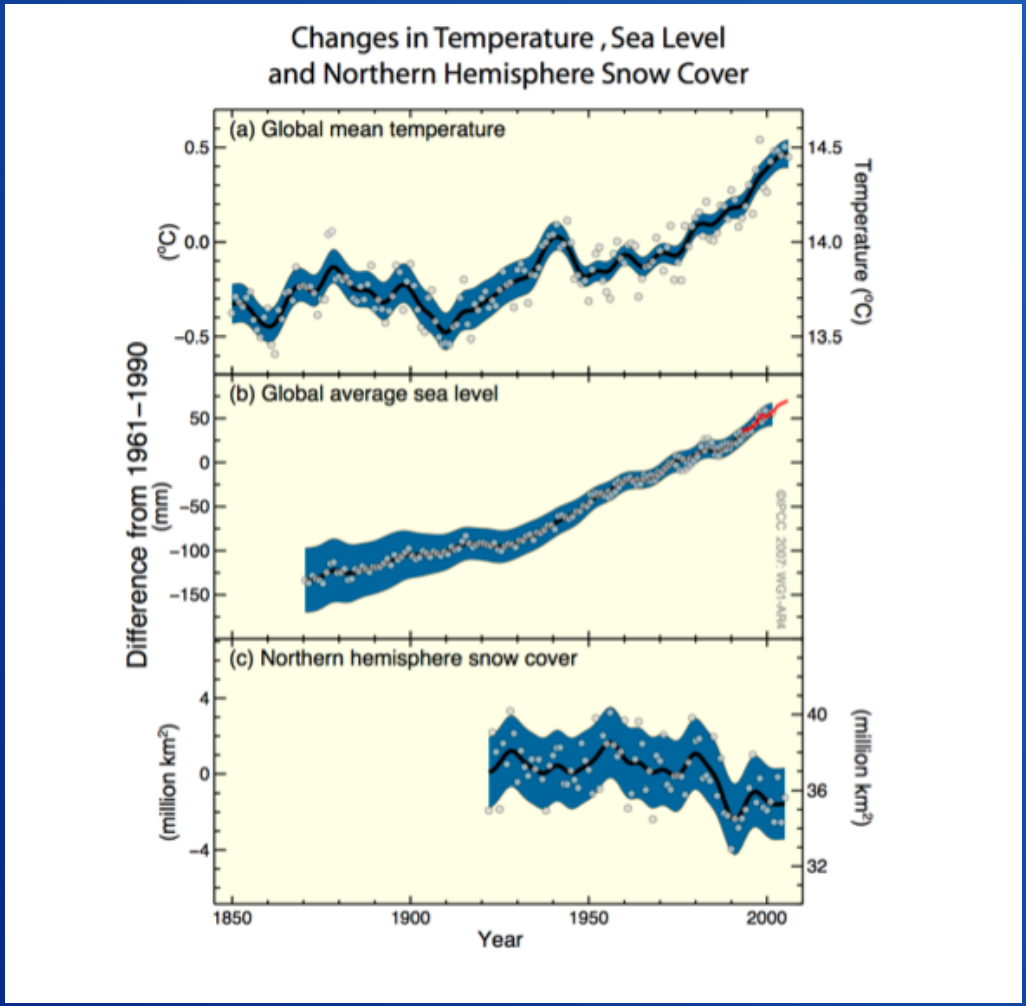
Climate may now be moving outside the historic range.



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Climate Change Research Partners

NOAA

USGS
science for a changing world

US Army Corps of Engineers®

western states water council

DEPARTMENT OF WATER RESOURCES

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Examples of Reclamation Climate Change Studies

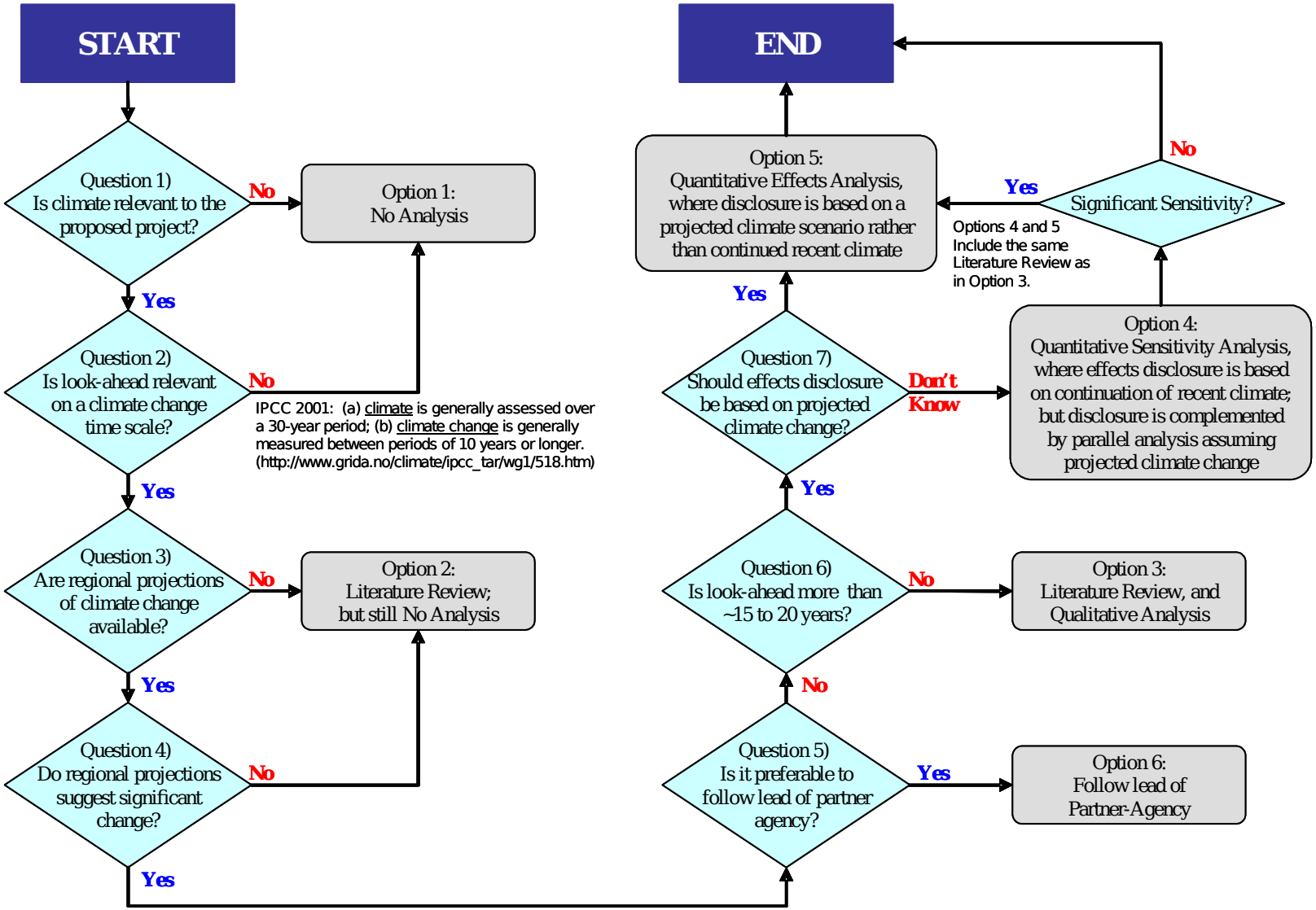
- **Climate Technical Working Group (Lower Colorado River)**
  - **Reclamation with NOAA, NCAR, USGS, U of Nevada, U of Arizona, U of Colorado**
  - **Long-term projections of climatic conditions in the basin, and potential effects on river operations.**

- **Yakima Basin Storage Study and Boise-Payette Rivers Study**
  - **How the yield of proposed storage alternatives would vary given projected climate changes.**

- **Effects of projected climate change on flood operation criteria:**
  - **Pilot study in California with U.S. Army Corps of Engineers**
  - **Conclusion: adjustments should be made in the drier years to reserve more flood control space.**

- **Technical guidance for incorporating information on climate change into various Reclamation planning and evaluation studies.**

Figure 1 – Potential Scoping Questions and Answers leading to Recommended Options: This chart illustrates a general guidance for considering whether and how to incorporate climate change information into project-specific planning (NEPA, ESA, etc). Implementations of options involving some level of analysis are described on Figures 2-5.


START
Question 1) Is climate relevant to the proposed project?
No
Option 1: No Analysis
Yes
Question 2) Is look-ahead relevant on a climate change time scale?
No
IPCC 2001: (a) climate is generally assessed over a 30-year period; (b) climate change is generally measured between periods of 10 years or longer. (http://www.grida.no/climate/ipcc_tar/wg1/518.htm)
Yes
Question 3) Are regional projections of climate change available?
No
Option 2: Literature Review; but still No Analysis
Yes
Question 4) Do regional projections suggest significant change?
No
Yes
END
Option 5: Quantitative Effects Analysis, where disclosure is based on a projected climate scenario rather than continued recent climate
Yes
Significant Sensitivity?
No
Options 4 and 5 Include the same Literature Review as in Option 3.
Yes
Question 7) Should effects disclosure be based on projected climate change?
Don't Know
Option 4: Quantitative Sensitivity Analysis, where effects disclosure is based on continuation of recent climate; but disclosure is complemented by parallel analysis assuming projected climate change
Yes
Question 6) Is look-ahead more than ~15 to 20 years?
No
Option 3: Literature Review, and Qualitative Analysis
No
Question 5) Is it preferable to follow lead of partner agency?
Yes
Option 6: Follow lead of Partner-Agency

Key Tasks

- **How to move from decisions under uncertainty to decisions under risk?**

- **Linking the environmental model (climate change) to the decision model (project operations/project planning) to determine sensitivities, tipping points.**

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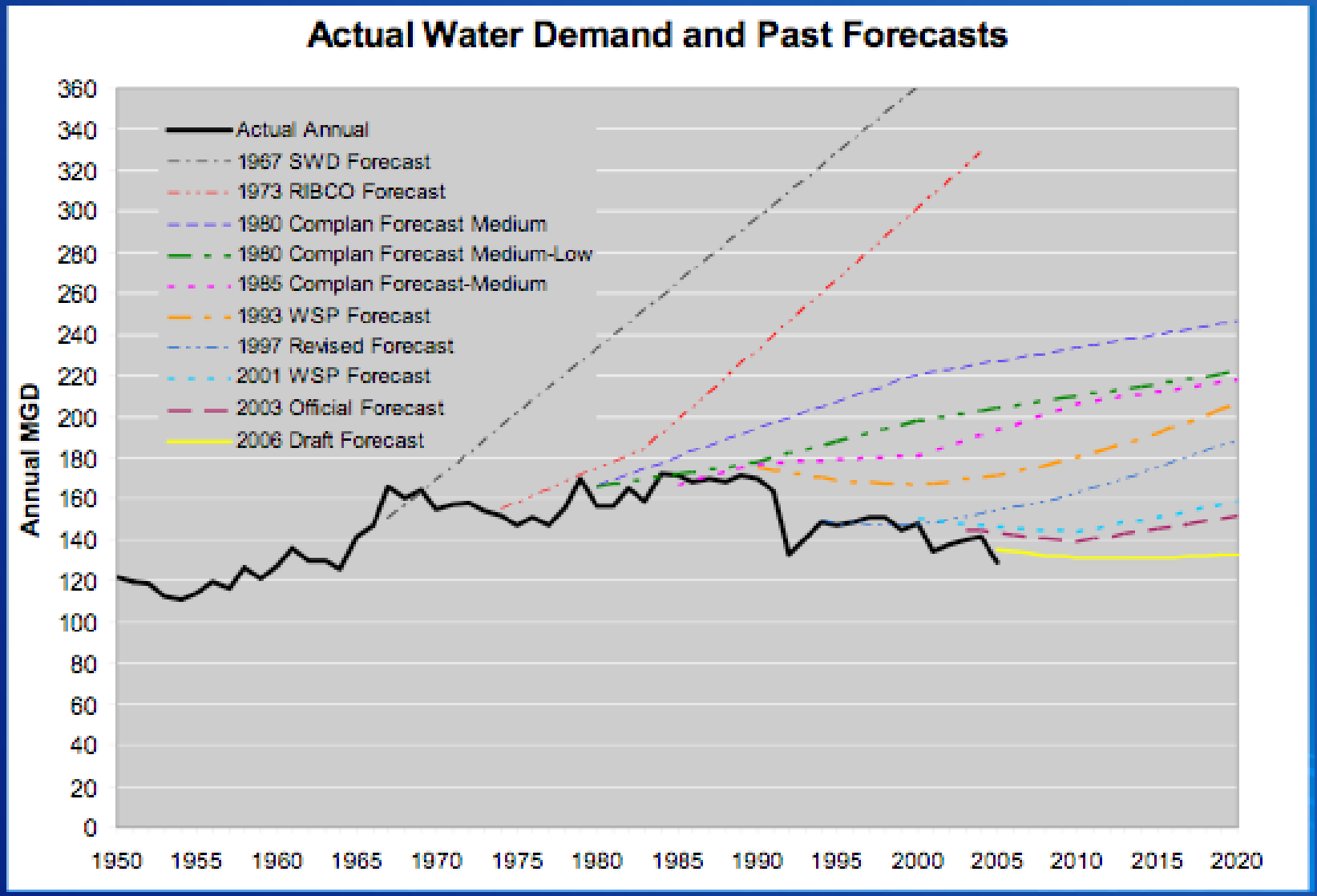

Chuck Clarke

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